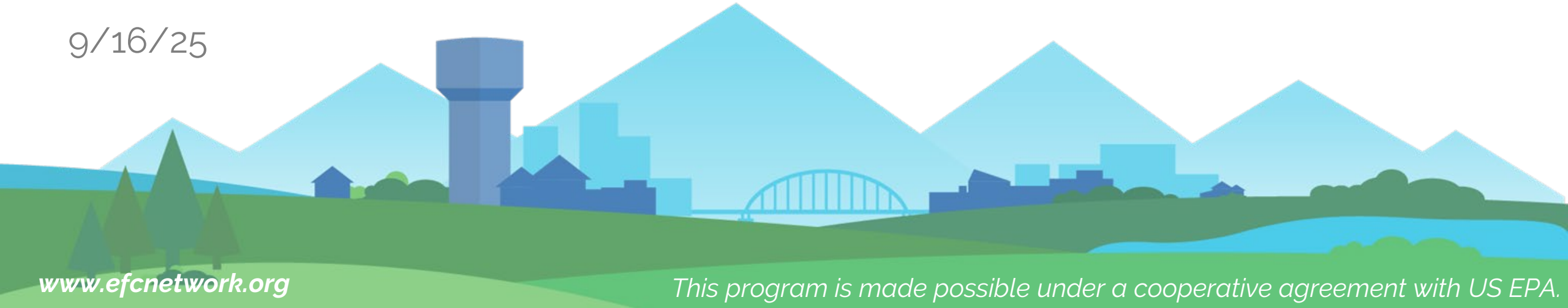
US Territories Wastewater Operator Training Series

Session 7: Collection Systems Part 3 – Maintenance

9/16/25



This program is made possible under a cooperative agreement with US EPA.

Your trainers for today:

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Research Engineer

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Professional Intern

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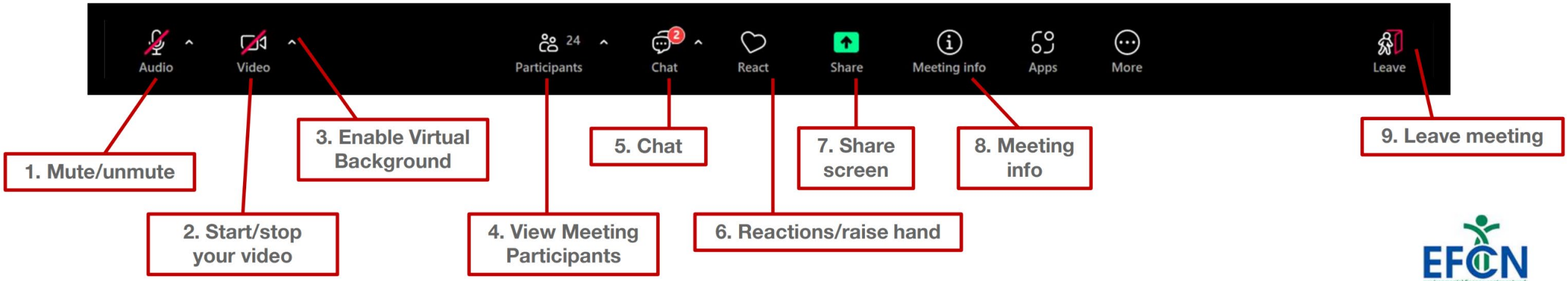
This training series is funded by the EPA

Attendee Meeting Controls

- Locate your control bar
- All attendees will see a black horizontal bar on their screen
- If your control bar is not visible, it may be hidden
  - Move your cursor to the screen's bottom (or top) to reveal this control bar.



WPI/ABC Operator Certification

Standardized Wastewater Treatment Operator Exams

Wastewater Treatment Operator Need-to-Know Criteria

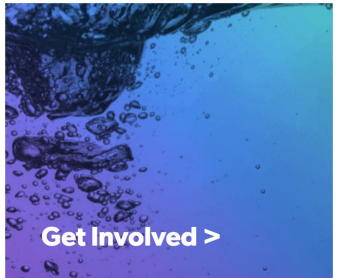
Need-to-Know Criteria outline the content that will be covered on WPI's standardized examinations provided through ABC Testing, a WPI service.

- Wastewater Treatment Operator Class I
- Wastewater Treatment Operator Class II
- Wastewater Treatment Operator Class III
- Wastewater Treatment Operator Class IV

Wastewater Treatment Operator Formula/Conversion Table

WPI standardized exams are administered with a Formula/Conversion Table containing mathematical formulas and common abbreviations that may be present on the exam.

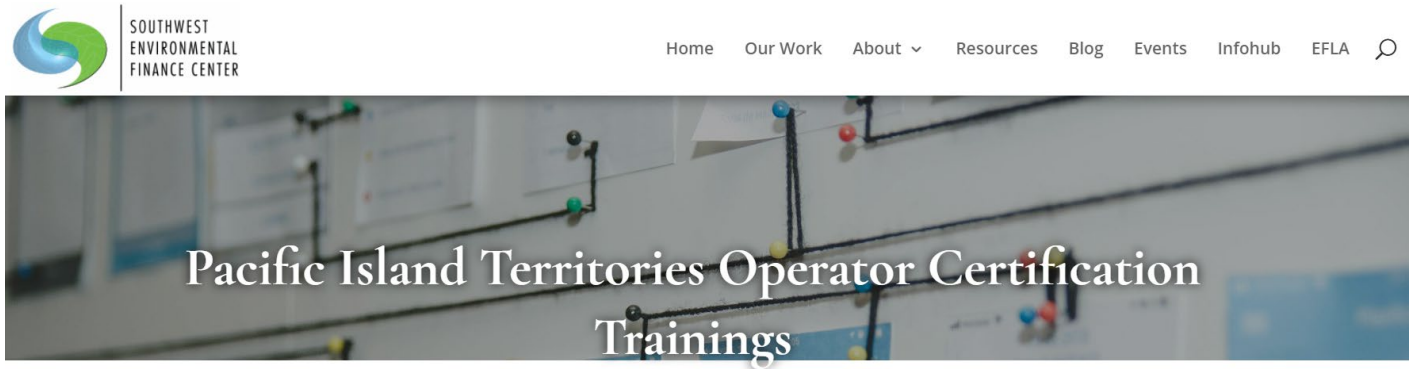
- Wastewater Treatment Operator Formula/Conversion Table



Schedule for 2025:

Date	Topic
6/24/25	Program Overview, Test Format, Study & Test Tips
7/8/25	Treatment Overview - Reg history, overview
7/22/25	WW Math Part 1 (Areas & Volumes)
8/5/25	WW Math Part 2 (Flow Rates & Detention Times)
8/19/25	Collection Systems - Gravity systems
9/2/25	Collection Systems - Pumping & force mains
9/16/25	Collection System Maintenance
9/30/25	Operator Safety/OSHA/Chemical Safety & Inventory
10/14/25	Preliminary Treatment
10/28/25	Primary Treatment: Sedimentation
11/11/25	Fixed-Film Media
12/2/25	Activated Sludge Part 1
12/16/25	Activated Sludge Part 2

https://swefc.unm.edu/home/op-cert-trainings/



This page is a repository of Wastewater and Drinking Water Operator Certification (Op Cert) Training Webinars offered by the SW EFC for systems in the Pacific Territories. Below you will find the **training webinar schedules (wastewater, then drinking water)** followed by a **training webinar recordings library.**

Jump to Wastewater Trainings ↓ Jump to Drinking Water Trainings ↓

Wastewater Training Schedule

Please note all times are local to CNMI and Guam. The times in American Samoa are one day earlier at 11 am.

Session	Date	Training Topic & Link to Recording (click to view)	Supporting Materials (click to download)
1	6/25/2025	Program Overview, Test Format, Study & Test Tips	PPT slides
2	7/9/2025	Treatment Overview	
3	7/23/2025	WW Math Part 1 (Areas & Volumes)	
4	8/6/2025	WW Math Part 2 (Flow Rates & Detention Times)	
5	8/20/2025	Collection Systems – Gravity systems	
6	9/3/2025	Collection Systems – Pumping & Force Mains	
7	9/17/2025	Collection System Maintenance	
8	10/1/2025	Operator Safety/OSHA/Chemical Safety & Inventory	

Sign in for **every session to** ensure you **get credit** for attending

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US Territories Water & Wastewater Operator Certification
Virtual Training Series Group Attendance Sheet

Session Title: _____

Session Date: _____

Training Location: _____

Attendee Name	Attendee Signature	Arrival Time	Departure Time

I hereby certify that the individuals listed above attended the referenced training session.

Name: _____

Signature: _____

Title: _____

Date: _____

Please scan this sheet after each training session and email it to swefc@unm.edu with the subject line: "US Territories Op Cert Attendance Sheet"

Why do we have to perform maintenance on our collection systems?

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Why do we have to perform maintenance on our collection systems?

Infrastructure degrades

Users treat wastewater as out of sight out of mind!

Many people don't think about what they flush

Maintenance is essential to:

- Prevent system failure
- Protect public health
- Ensures regulatory compliance
- Extends infrastructure lifespan
- Prevents emergency costs

Common Collection System Issues

Obstructions

Structural

Environmental

Infiltration and Inflow (I/I)

Obstructions- Debris

Debris- Unwanted solid material that enters the wastewater collection system and can obstruct or impair flow.

- Trash- Rags, wipes, plastic, rubber, paper
- Grease and Fats
- Sand, grit, gravel, construction material
- Leaves and sticks
- Excessive wastewater solids

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Obstructions- Root Intrusions

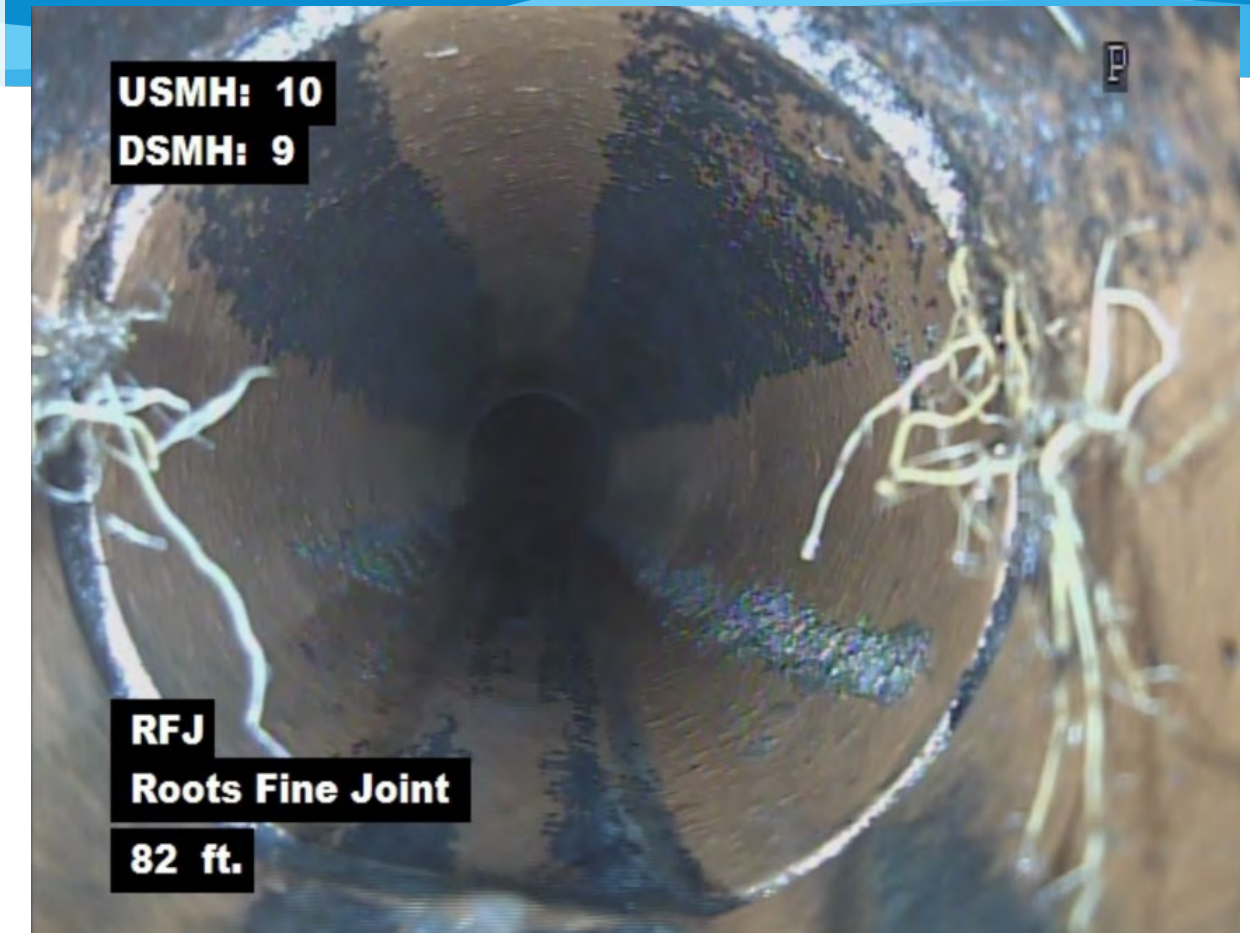
Plant roots seek out water in collection system pipes through:

- Cracks
- Broken Joints
- Poorly Sealed Connections
- Weak Spots

Root growth increases issues and roots accumulate debris

Root intrusions are more likely in:

- Old and deteriorating pipes
- Clay or concrete pipes
- Dry soil
- Areas near vegetation



Issues Causes by Obstructions

- Blockages and Backups- Leads to sanitary sewer overflows (SSO)
- Pump Damage- Debris damages impellers and clogs pumps leading to mechanical failure
- Reduced Flow Capacity
- Increased Maintenance Requirements
- Environmental and Health Hazards- SSOs threaten public health and contaminate surface waters
- Broken Pipes- Mainly due to growing roots

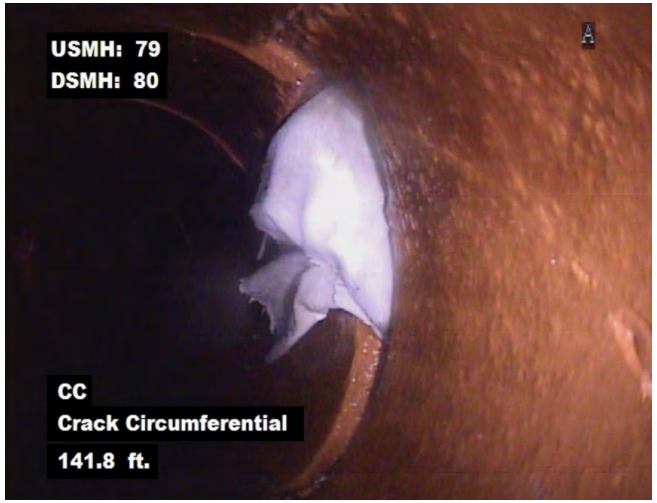
Addressing Obstructions

Remove obstructions and prevent accumulation by:

- Routine Cleaning- Hydro jetting, mechanical rodding, and vacuuming
- Inspection- CCTV inspections, flow measurement and visual observation
- Public Education- Campaigns to educate the public on the risks of excessive debris and fats, oils and grease (FOG) in the system

Root intrusions are removed through

- Root Clearing- Hydro jetting and mechanical rodding
- Chemical Treatment- Herbicides used to kill roots and prevent regrowth
- Pipe Replacement and Repair- Correct damaged pipes
- Correct Planning



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Structural Issues

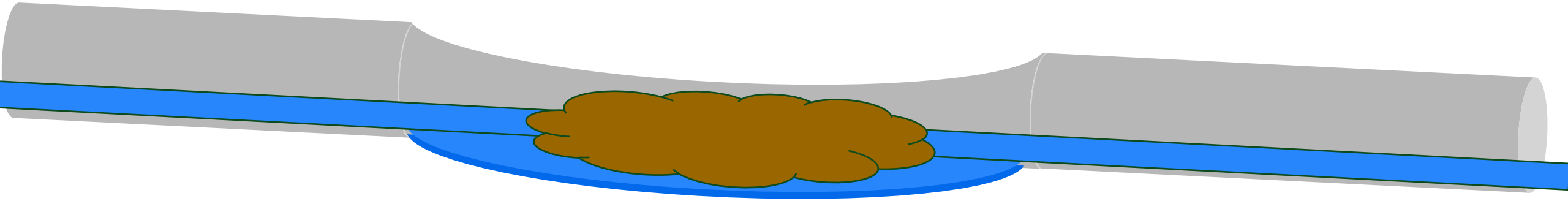
Problems that effect the physical integrity of pipes and other collection system infrastructure

Cracked or broken pipes
Collapsed lines
Deformed pipes
- Line sags

Pipe misalignment
Offset or separated joints
Manhole damage

Require replacement, relining, and/or spot repairs

Pipe Sag



Environmental Issues

Chemical and biological issues that typically result from untreated waste or poorly managed system

Corrosion- Sulfuric acid

Odors- Hydrogen Sulfide, ammonia, methane (flammable)

Sanitary Sewer Overflows- Expose public and environment to untreated wastewater

- Contaminates surface waters, spreads pathogens and harms wildlife (especially aquatic life)

Prevented by proper sewer design and management

➢Using non-corrosive materials

➢Educational outreach


Inflow

Infiltration

I & I – What it is

- **Inflow** – Water entering through manholes and illegal connections
- **Infiltration** – Groundwater entering sewer through breaks or joints or broken manhole barrels
- Can cause **hydraulic overload** at the WWTP or SSOs and **should be limited whenever possible**

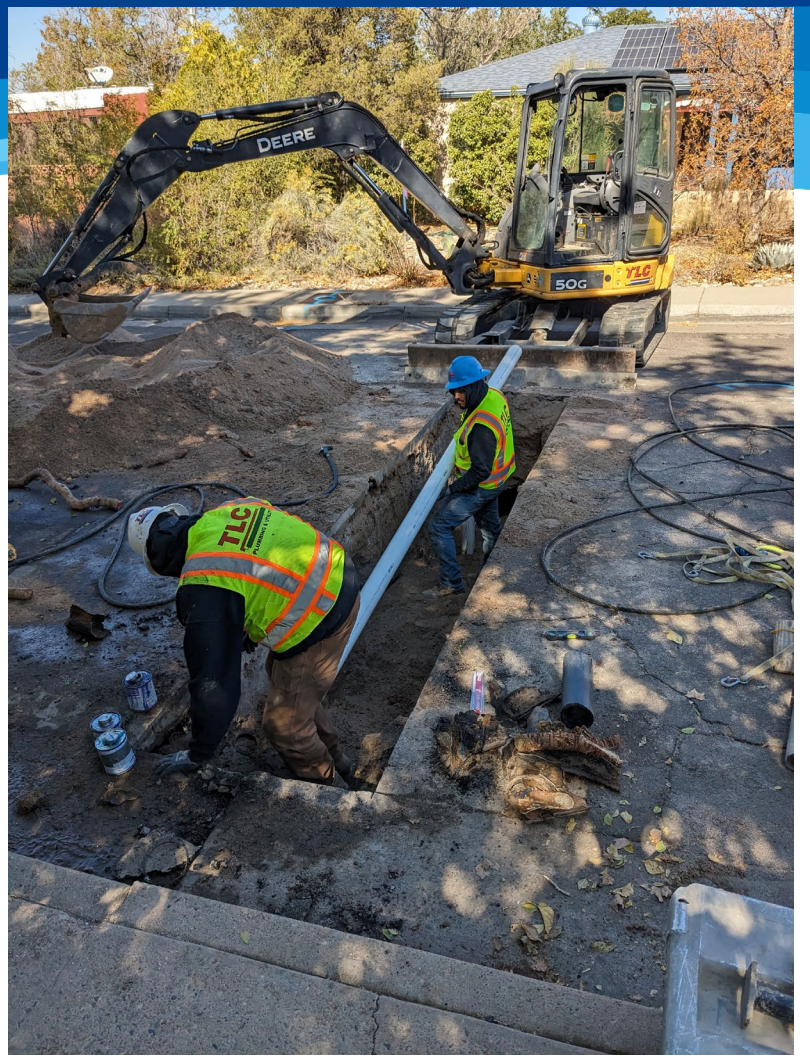
I & I - Identification

- **Identification** can be **complex** and **costly**
- Methods used include:
  - **Late Night Surveys** (checking manholes for clear water flow 2-4 am)
  - **CCTV inspection** (prior line cleaning important)
  - **Smoke Testing** – through manhole covers
  - **Flow Record Analysis**

I & I – Controlling it

- **Many methods**
  - Pipe replacement
  - Slip lining
  - Pipe bursting
  - Chemical grouting
  - Storm sewer improvement
- **Often requires outside contractors**
- Collection crews can often deal with manholes by fixing deterioration, raising rings, repairing joints, etc.

Night time monitoring for clear water during low flows (2-4am)



Collection System Monitoring

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Visual Inspections

Using visual observations to assess the condition of sewer pipes and manholes

Surface Inspections- Overflows, sinkholes, pavement cracking and deformation, unusual wet areas, and unusual odors

- Can also be used to identify illicit discharges

Manhole Inspections- utility works can identify cracks, deterioration and corrosion, I & I, build ups

Closed-Circuit Television (CCTV)

Use of specialized video cameras to observe and record the interior of sewer systems

Used to inspect the interior of pipes for cracks, blockages, root intrusion, corrosion, and structural defects

Provides video documentation for condition assessment and maintenance planning

Process includes:
Deployment of video equipment
Real-time observation
Video recording
Reporting

CCTV is considered simple, safe and cost effective

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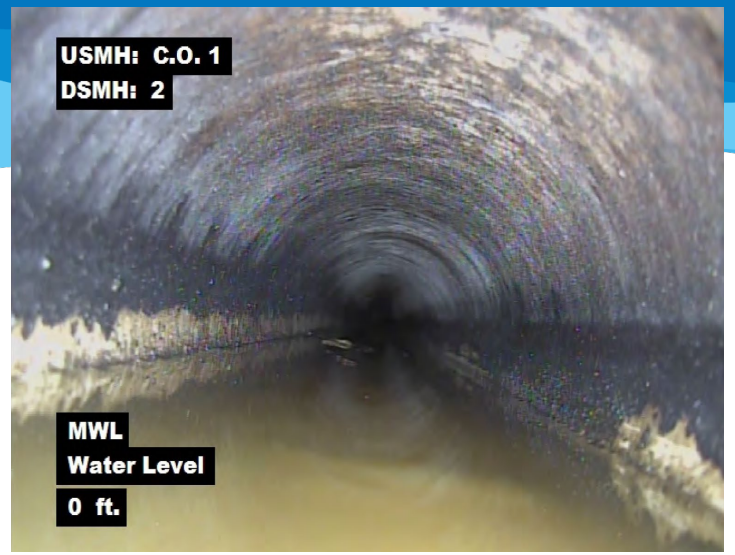
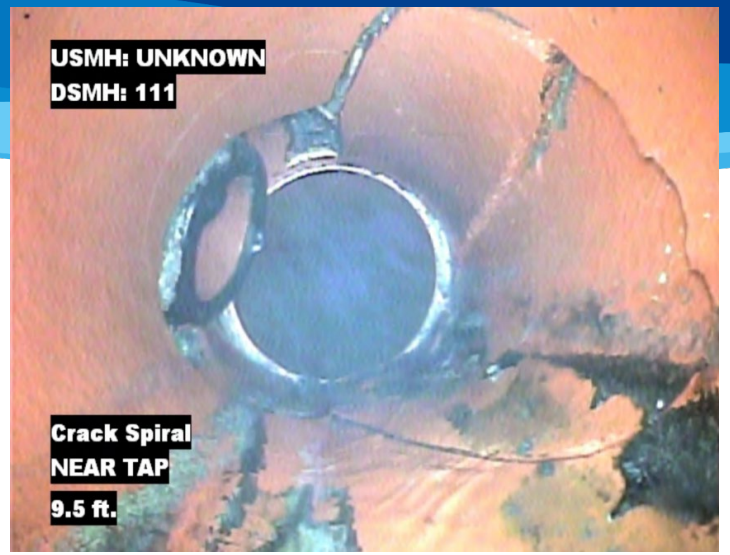
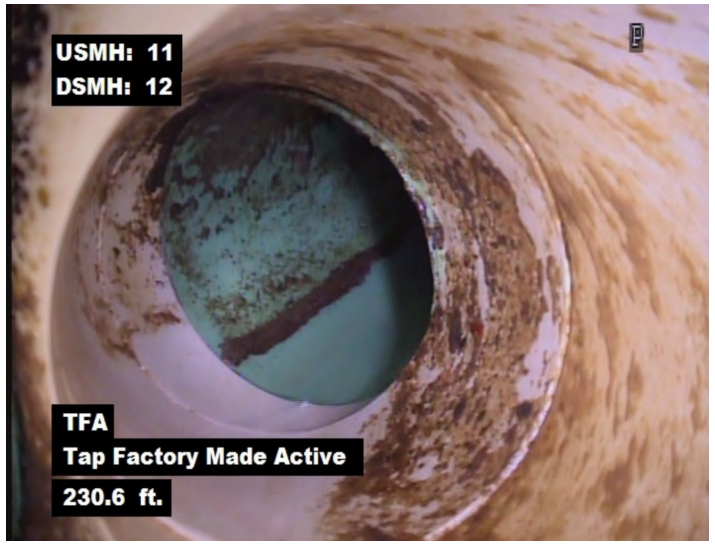
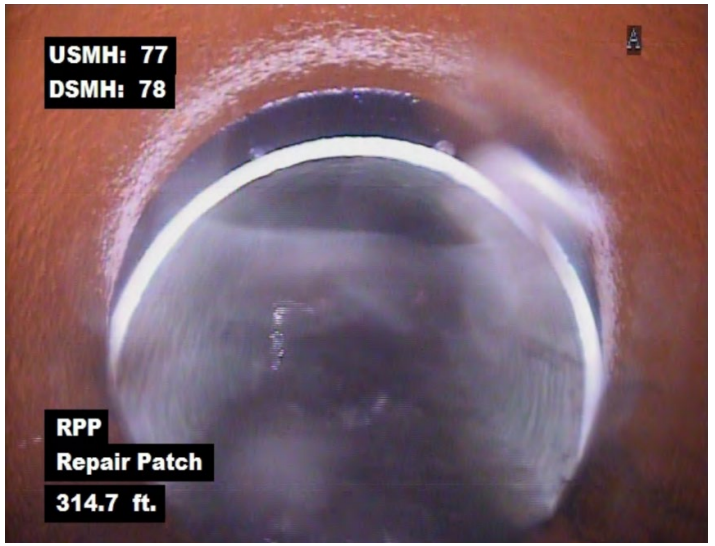
CCTV

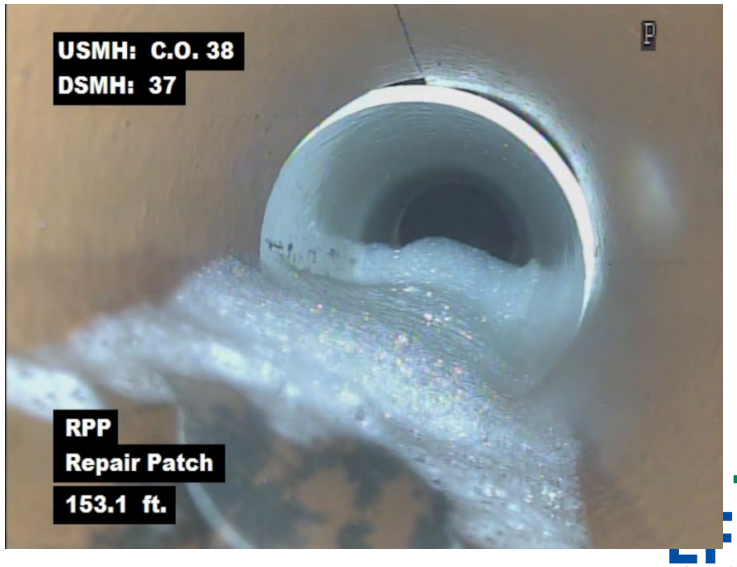

USMH: C.O. 1
DSMH: 2
MWL
Water Level
0 ft.


USMH: UNKNOWN
DSMH: 111
Crack Spiral
NEAR TAP
9.5 ft.


USMH: C.O. 17A
DSMH: 17
MWL
Water Level
0 ft.


USMH: 11
DSMH: 12
TFA
Tap Factory Made Active
230.6 ft.


USMH: 77
DSMH: 78
RPP
Repair Patch
314.7 ft.


USMH: C.O. 38
DSMH: 37
RPP
Repair Patch
153.1 ft.

Flow Monitoring

Measuring flow rates to identify flow patterns that determine problems

Flow meters and level sensors are installed in strategic locations to track:

Flow rates

Peak flows

Diurnal patterns

Helps identify inflow and infiltration (I/I), blockages, and hydraulic bottlenecks

Data is recorded and transmitted to a central system or downloaded manually

Smoke Testing

Introduces visible, non-toxic smoke into sewers to detect defects, illegal connections or leaks

Smoke generator is connected to manhole or cleanout to force smoke into the sewer system

Workers walk the system to identify defects where smoke escapes where it shouldn't

Smoke locations should be recorded, mapped, and photos taken to facilitate repairs

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Other inspection methods

Dye Testing

Traces flow paths and confirms suspected cross-connections or infiltration sources

Acoustic and Sonar Inspections

Acoustic sensors detect blockages by analyzing sound waves in the pipe.

Sonar profiling is used in submerged pipes to assess sediment buildup and pipe shape.

Collection System Maintenance

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Addressing Obstructions

Remove obstructions and prevent accumulation by:

- Routine Cleaning- Hydro jetting, mechanical rodding, and vacuuming
- Inspection- CCTV inspections, flow measurement and visual observation
- Public Education- Campaigns to educate the public on the risks of excessive debris and fats, oils and grease (FOG) in the system

Root intrusions are removed through

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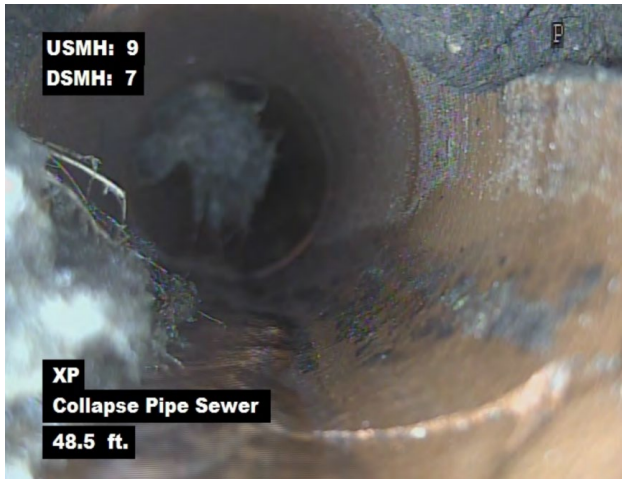

Preventative vs Emergency Maintenance

Preventative- Scheduled, proactive work aimed at reducing the likelihood of system failures and extending asset life

- Planned and Budgeted, reduces emergency incidents, improves system reliability, and limits regulatory violations
- Ex. Routing jetting and cleaning, CCTV, grease trap inspections, pump station equipment inspections and manhole inspections

Emergency- Unplanned, reactive work performed in response to a failure or urgent issue

- Needed suddenly and without warning, more costly than preventative, interrupts service, often due to lack of preventative
- Ex. Repairs for collapsed sewer lines, pump station bypass, removal of blockages (SSOs), manhole replacement

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Jetting/ Hydraulic Cleaning

Method to remove debris, grease, sediment, and other blockages from sewer lines using high-pressure water.

Jetting utilizes:

Specialized vehicle with water tank and pump

Hose and nozzle inserted into the sewer line

Water pressure of 1,500-4,000 psi

Nozzles designed to break up blockages and flush debris

Debris removed downstream with vacuum or at WWTP

CCTV to confirm obstructions are removed

Jetting Nozzles

Mechanical Cleaning

Method to clean sewers by physically scraping, cutting, or out pulling debris using specialized mechanical tools

Processes sometimes resemble jetting

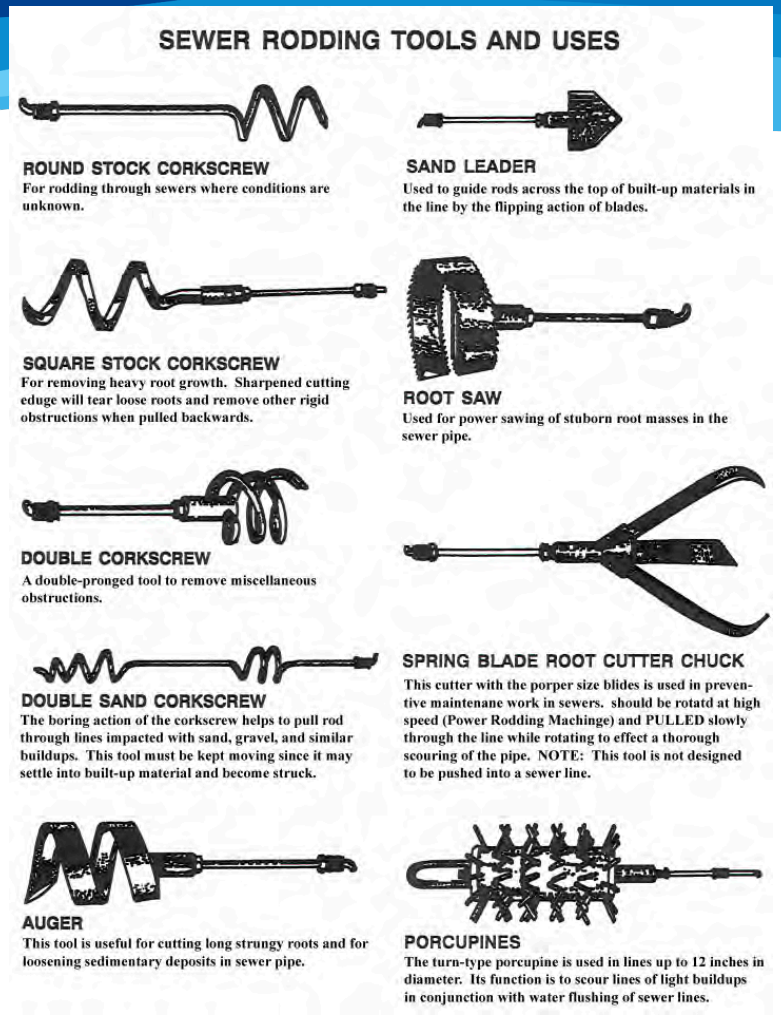
Rodding- Steel tools that rotate mechanically or by hand

- Ex. Circular cutters, corked screws/augers, etc.
- Hand rodding tools are used in difficult to access lines
- Combined with jetting technology to flush debris

- Rodding is directed from upstream to downstream

Pigging- Using a snug fitting "pig" to scrape and clear sewers

Bucket Machines- Bucket pulled by a cable through lines



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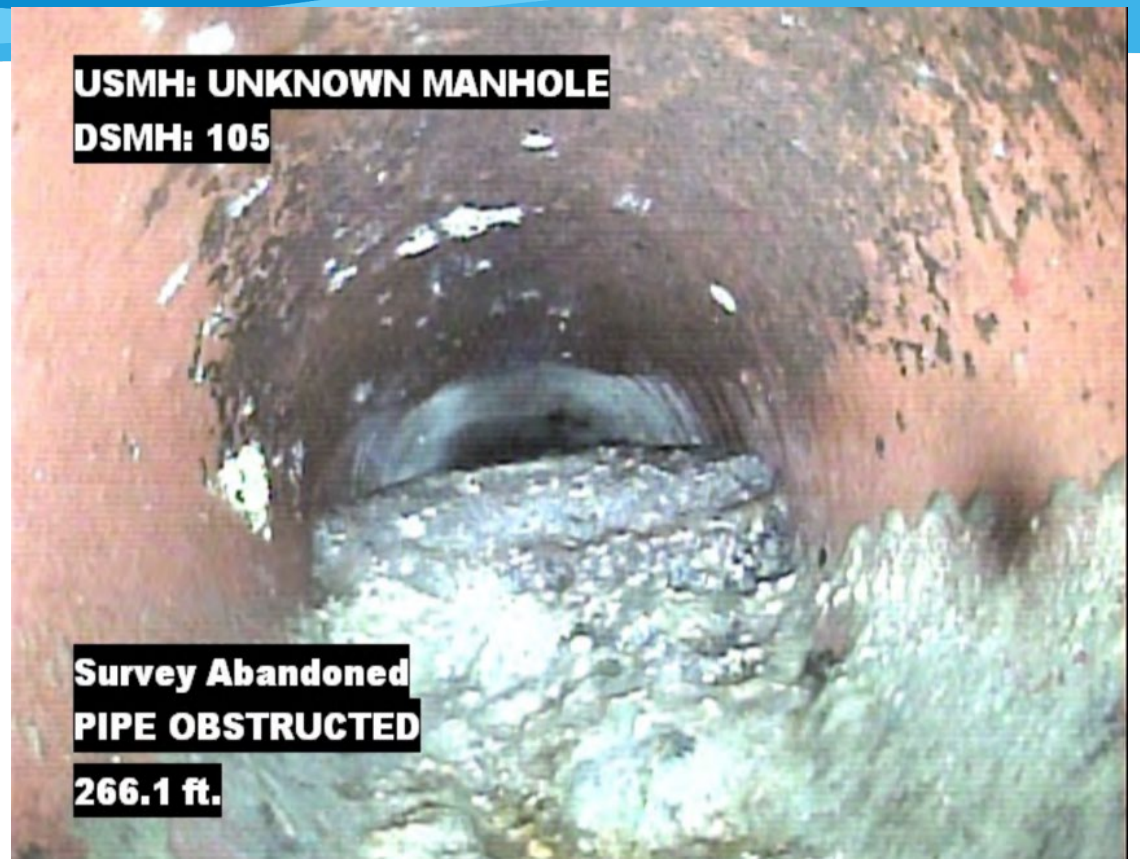
Chemical Cleaning

- Use of chemicals designed to target grease, roots, scale, or organic buildup to remove them from the sewers
- Applied by pouring, spraying or injecting chemicals upstream of the blockages
- Degreasers
- Root control (herbicides)
- Descalers
- Biological enzymes
- Effective for difficult areas and are gentle on sewers, but care must be taken to use sewer and environmental safe products

Cleaning “Fatbergs” or “Greasebergs”

- “Fatbergs” are large obstructions that result from FOG
- Removed using a combination of standard cleaning techniques including entry using divers
- Prevented using effective FOG Pretreatment Programs



Collection System Repairs

Excavation/ Open-Cut Repairs- Traditional method to excavate and replace damaged pipe or sections

Cured-in-Place Pipe- A resin-saturated liner is inserted into the pipe and cured to form a new pipe inside the old one

Pipe Bursting- A bursting head breaks the old pipe replace it with a new pipe pulled behind it

Slip Lining- Smaller pipe inserted into existing pipe

Spot Repairs- Fiberglass or resin patch applied internally

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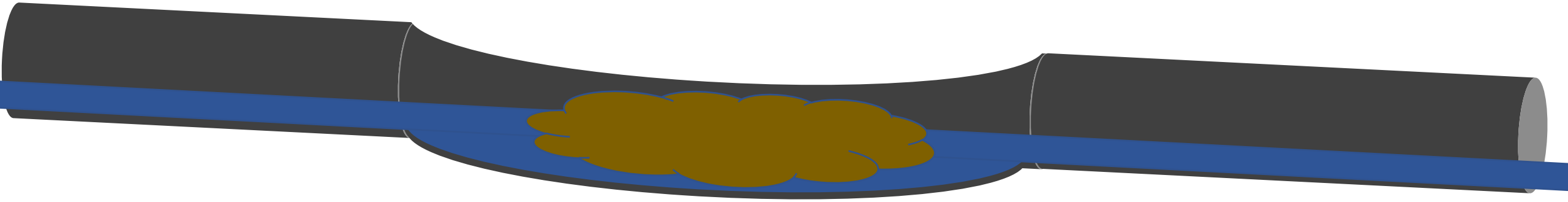
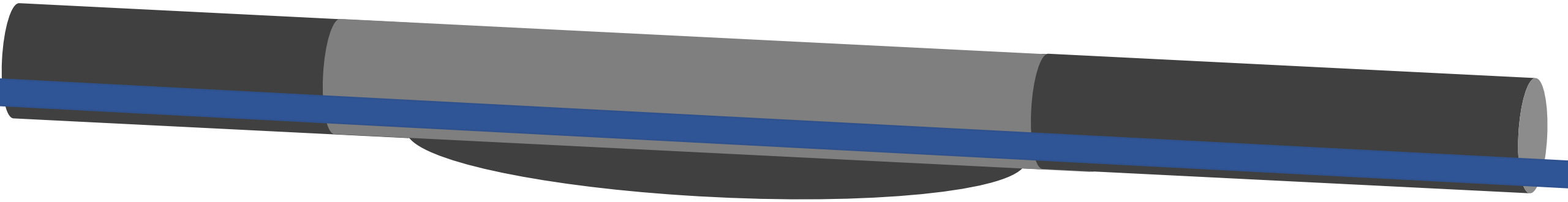
Slip Linning

Pipe Bursting

Pipe Sag



Pipe Sags Often Need Replacing



Trenching

Excavation of narrow channels for utility installation

Trenching Steps:

Planning- Utility location, obtain permits, traffic control

Excavation- Digging and dewatering

- Use shoring and trench boxes if necessary

Pipe replacement- pipe cutting, bedding and installation

Backfilling and Surface Restoration

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Manhole Repairs

Utilized due to excessive deterioration, increase capacity, safety hazards, and increased I&I

Manhole repair steps:

Assessment and Planning- Rehabilitation is preferred over replacement

Surface Preparation- Remove debris, sand and contaminants

Structural Repair and Grouting- Repairs to address manhole issues or patches to address cracks and minor deterioration

Lining and Coating- To protect against corrosion

Maintenance Safety

Confined Space Hazards- Oxygen deficiency, toxic gases, limited accessibility

➢Communicate with other employees

Traffic- Sewer work is typically required near or on roadways

Physical Hazards- Slip, trips, and falls, and structural instability

Chemical and Biological Exposure- Toxins and pathogens

Electrical Risks- Hazards from electrical equipment used in wastewater

Collection System Maintenance Program and Scheduling

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Maintenance Planning and Scheduling

Used to organize routine, preventative, corrective, and emergency maintenance

- Prioritize high-risk areas to prevent blockages
- Should be based on condition, age, material and historical data

Calendar-based or condition-based scheduling

Determine communication procedures and data requirements

Creating a Maintenance Plan

System Overview- Utility information, purpose, responsibilities

Asset Inventory- Asset ID, location, pipe details, installation date, last inspection date, condition rating and connected components

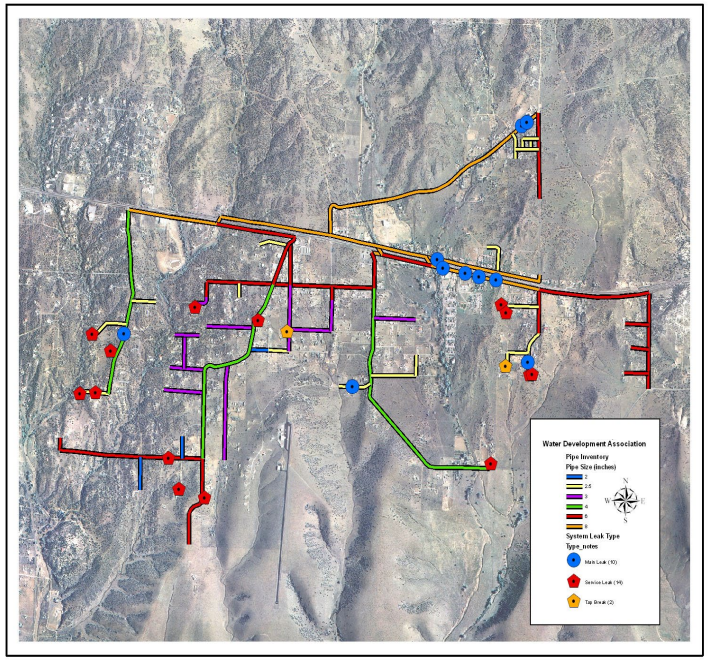
➢GIS and Mapping

Maintenance Scheduling: Types of maintenance, frequency, priority level, next schedule date, assigned personnel

Inspection Scheduling: Inspection date, inspection method, inspection results, recommended actions, photos/videos

Work Order System: Provides task assignment and tracking

Reporting and Analytics: trends, budget forecasting, hotspots



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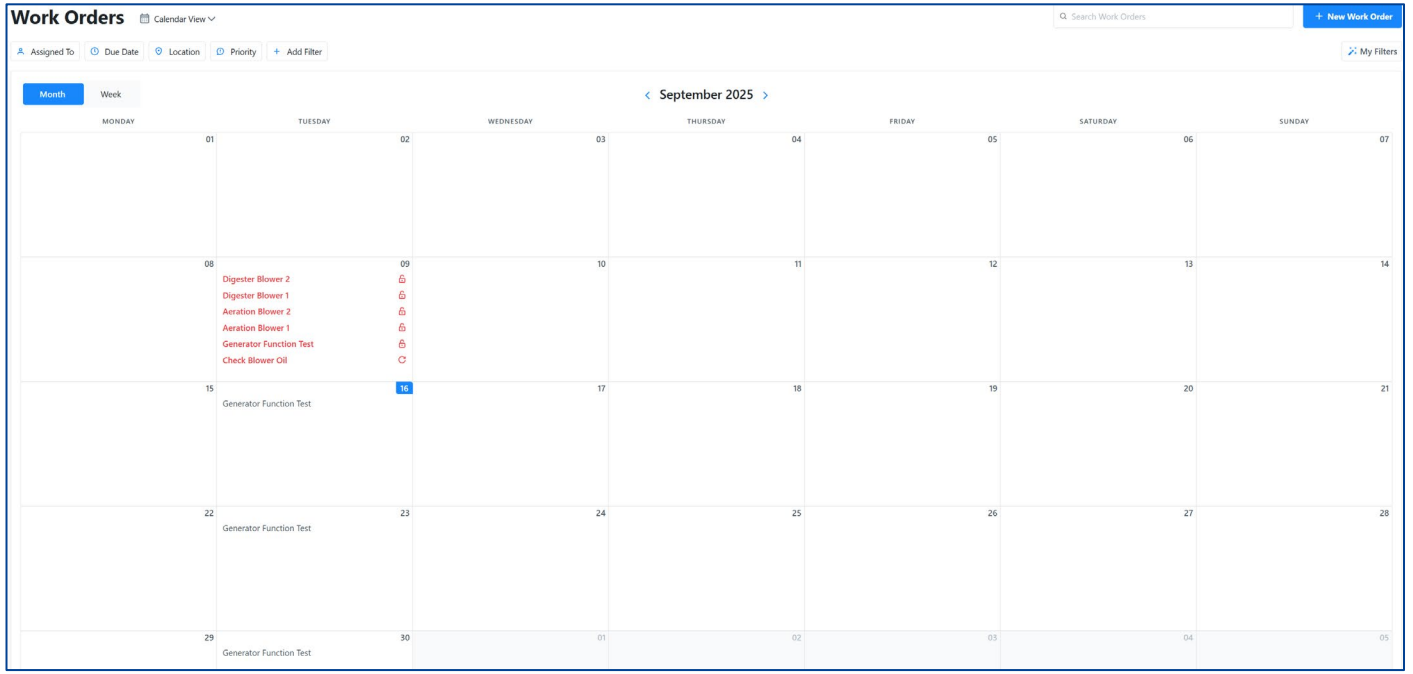
Maintenance Schedule Tools

Paper Records

Excel- Utilizes manual inputs

CMMS- Provides automatic work order creation, provides template for asset inventory, may provide preventative maintenance schedule and advanced asset management tools, some free options



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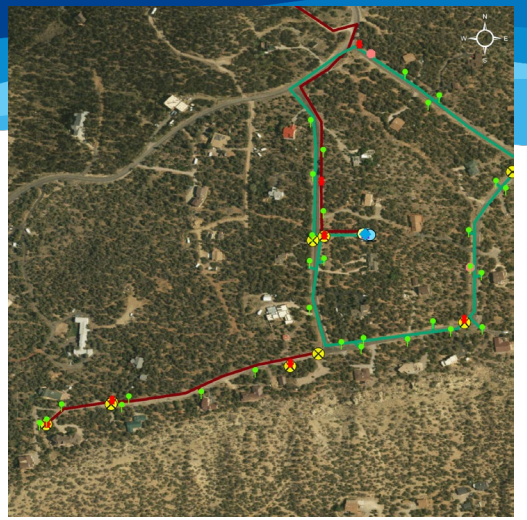
Mapping

Geographic Information Systems (GIS)- Provides mapping and spatial information to allow utilities to visualize their assets

- Asset location and identification
- GPS coordinates
- Flow direction
- Connections
- Access points
- Environmental and regulatory zones



FOG Program

Designed to minimize impact of FOG on the collection system

FOG Program Components:

Food producers- Grease trap installation, best management practices, documentation

Public Education- Cool-It, Cap-It, Toss-It

Monitoring Program- Monitoring collection system and food producers

Enforcement- Violations, penalties and compliance requirements

SSOs

SSO Team- Documents incidents and plans responses, notifies regulatory personnel

Detection and Notification- System alarms, inspections, public notifications

Response Procedure:

- Containment
- Cleanup
- Disinfection

Utilize the data collected for your collection system maintenance program

Questions?

CONTACT INFORMATION

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